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Gwynia capsula (Jeffreys, 1859) and other Recent brachiopods from submarine caves in Croatia

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Abstract

Recent brachiopods were collected in submarine caves along the Croatian coast of the Adriatic Sea. In a karstic cave at U Privlaka, Lošinj Island, the micromorphic brachiopod *Gwynia capsula* (JEFFREYS, 1859) has been found for the first time in the Mediterranean Sea. In the same cave, the rhynchonellid brachiopod, *Tethyrhynchia mediterranea* LOGAN, 1994, is also abundant. The geographic distribution of these two species is now considerably extended.

Key words: Brachiopoda, Mediterranean, taxonomy, *Gwynia.*

Résumé

Des brachiopodes Récents ont été collectés dans des grottes sous-marines au large des côtes croates de la Mer Adriatique. *Gwynia capsula* (JEFFREYS, 1859) a été découverte pour la première fois en Méditerranée dans une grotte située à U Privlaka, île de Lošinj. L'unique brachiopode rhynchonellide connu en Méditerranée, *Tethyrhynchia mediterranea* LOGAN, 1994, est également abondant dans cette même caverne. L'extension géographique observée pour ces deux espèces est importante.

Mots-clefs: Brachiopoda, Méditerranée, taxonomie, *Gwynia.*

Introduction

Eleven Recent brachiopod species from the Mediterranean Sea were described and illustrated more than a century ago by DAVIDSON (1886-1888). A taxonomic guide to Mediterranean brachiopods, by LOGAN (1979), deals with the same eleven species. In 1994, however, a new rhynchonellid brachiopod, collected from submarine caves along the Mediterranean coasts of France and Tunisia, was described by LOGAN (*in* LOGAN & ZIBROWIUS, 1994) as *Tethyrhynchia mediterranea*, and represented the first record of a rhynchonellid in the Mediterranean Sea. This representative of a new brachiopod family, has considerable taxonomical and ecological interest. The fauna of submarine caves, particularly the micromorphic brachiopods, have not been completely investigated and attention must be paid to this special biocoenosis.

Material and methods

Bioclasts of brachiopods were collected by one of us (G.W.) using SCUBA along the Croatian coast. Sediment samples were collected from various depths (3 - 60 m), at different stations, including several submarine caves, near Lošinj Island, northern Adriatic (Figure 1). To avoid overlooking extremely small brachiopods, the samples were passed through a 0.3 mm sieve. The material is preserved in the collections of the Institut royal des Sciences naturelles de Belgique in Brussels.

Results

The most interesting brachiopod assemblage was collected at a depth of 35 m from a karstic, semi-dark cave situated in U Privlaka (Figure 1). Its one and only entrance is small, and its volume reaches ±30 m³. Inside, the movement of water is reduced. The water temperature varied from 11°C in November to 13°C in July 1997. This slight difference of temperature does not favour water movement. The walls and roof of the cave are full of cavities. The surface available for brachiopod attachment is increased by the permanent activity of the rock-boring mollusc, *Lithophaga lithophaga* (L., 1758). Light attenuation leads to a presumed reduction of food resources, limiting the development of algae, bivalves and other sessile animals. Sponges and bryozoans are rare and quite small. Cirripedes, worm tubes and solitary cnidarians are more abundant. Under such conditions, micromorphic brachiopods, with low nutritional requirements, have a competitive advantage for surviving in cryptic habitats (LOGAN & ZIBROWIUS, 1994, p. 87). In the cave of U Privlaka, reduced competition for space still exists between brachiopods and two fixed bivalves which are not uncommon: *Arca tetragona* POLI, 1795 and *Modiolula phaseolina* (PHILIPPI, 1844).

A rich brachiopod fauna has been observed (Fig. 2). Six brachiopod species were collected from the U Privlaka cave: one Craniidae: *Neocrania anomala* (MÜLLER, 1776); one Tethyrhynchiidae: *Tethyrhynchia mediterranea* LOGAN, 1994; three Megathyrididae: *Argyrotheca cuneata* (RISSO, 1826), *A. cordata* (RISSO, 1826), and *A. cistellula* (SEARLES-WOOD, 1841) and one *ex* Megathyrididae:

Gwynia capsula (JEFFREYS, 1859), recently removed from this family by LOGAN, MACKINNON & PHORSON (1997, p. 250). The relative abundance of these six brachiopods is indicated in Figure 2.

N. anomala and *A. cuneata* are clearly visible, in living position, on the roof of the cave. *N. anomala* is the most common brachiopod in all caves from the Lošinj area. *A. cuneata*, although common in caves, is also observed on the drop off, attached to various small substrates. Adults of *A. cordata* are uncommon in caves, but frequent on the drop off, colonising a lot of small, hard substrates. Above 30 m, *A. cordata* is rarer. *A. cistellula* was considered as a rare species in the Mediterranean (LOGAN, 1979, p. 43) but it has probably been overlooked, because of its small size. A few specimens were found in the area of Lošinj, at the base of the drop off. However, in the U Privlaka cave, *A. cistellula* is clearly the dominant micromorphic species (Figure 2). Specimens collected are typical and their shell morphology fits the emended description and illustrations recently published by LOGAN, MACKINNON & PHORSON (1997, p. 245, pl. 3, figs. 3-10, p. 246) perfectly.

Micromorphic species as *Tethyrhynchia mediterranea* and *Gwynia capsula,* were found only collected in the semi-dark karstic cave of U Privlaka. This new discovery of *T. mediterranea* in the Adriatic extends its geographic distribution to the eastern Mediterranean basin, suggesting that this rhynchonellid brachiopod is probably distributed in the whole Mediterranean region. Its origin remains unknown but investigations in submarine caves along the Atlantic coasts could clarify this situation.

G. capsula, an eastern Atlantic brachiopod, is found around the coasts of the British Isles, northern France, the Netherlands, Norway, and north-western Spain (JEFFREYS, 1878; DUPREY, 1883; DAVIDSON, 1887; BOADEN, 1963; SWEDMARK, 1967, 1971; RIOULT, 1971; BRUNTON & CURRY, 1979; BESTEIRO & URGORRI, 1984; PHORSON, 1988; HARPER *et al.*, 1996; LOGAN *et al.*, 1997). Its occurrence in the northern Adriatic, and thus for the first time in the Mediterranean, considerably extends its geographical distribution. This is another argument for considering Recent Mediterranean brachiopods as immigrant species from the Atlantic, via Gibraltar, at the beginning of the Pliocene (HSÜ, 1974; HSÜ *et al.*, 1973). Other caves explored in the area of Lošinj Island yielded numerous *N. anomala* and *A. cuneata* and a few *A. cordata* and *A. cistellula*, but *T. mediterranea* and *G. capsula* were not observed. In these caves, situated at a lesser depth (from 3 to 10 m), fresh water springs may modify the local salinity.

Systematic descriptions

Phylum Brachiopoda DUMÉRIL, 1806
Subphylum Rhynchonelliformea WILLIAMS *et al.*, 1996
Class Rhynchonellata WILLIAMS *et al.*, 1996
Superfamily Rhynchonelloidea D'ORBIGNY, 1847

Nomenclative note: the family-group names based on *Rhynchonella* should be attributed to D'ORBIGNY, 1847 and not to GRAY, 1848 (MANCEÑIDO, OWEN & MORRIS, 1993 p. 197).

Family Tethyrhynchiidae LOGAN, 1994
Genus *Tethyrhynchia* LOGAN, 1994

Type species: *Tethyrhynchia mediterranea* LOGAN, 1994

Tethyrhynchia mediterranea LOGAN, 1994
Plate 1, Figures 3 a-c, 4 a-d.

* 1994 *Tethyrhynchia mediterranea* LOGAN *n. sp.* - LOGAN & ZIBROWIUS, pp. 77-88, plate 1, figs. 1-14, plate 2, figs. 1-9.

. 1997 *Tethyrhynchia mediterranea* LOGAN - LOGAN, MACKINNON & PHORSON, p. 240.

Material: 128 complete shells, 66 dorsal valves and 72 ventral valves collected from a submarine cave at U Privlaka (-35 m).

The specimens are extremely small, their size rarely exceeding 1 mm (largest individual: 1.40 mm long and 1.15 mm wide). Externally, the shell is smooth. The beak is slightly curved with an elongate-triangular, hypothyrid foramen limited by two small, disjunct, deltidial plates. In the ventral valve, an incomplete pedicle collar is observed and the teeth are relatively strong. Dental plates are absent. The dorsal valve has no cardinal process. Long and typical crura of the lunifer type support a trocholophous lophophore. These Croatian specimens fit perfectly with the original description given by LOGAN (1994).

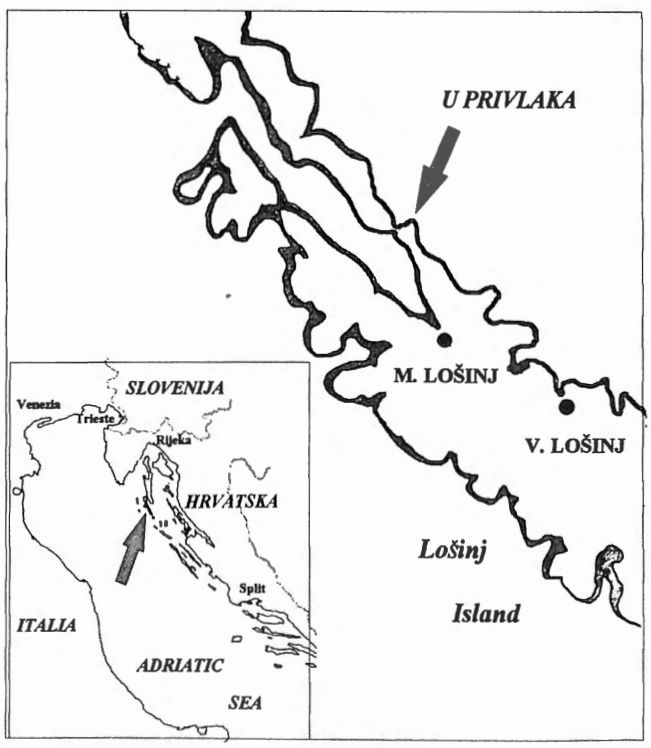

Fig. 1. – Map illustrating the area of Lošinj Island (northern Adriatic, Croatia) and a detail of Lošinj Island with situation of the submarine cave at U Privlaka.

Order Terebratulida WAAGEN, 1883
Suborder Terebratellidina MUIR-WOOD, 1955
Superfamily Uncertain
Family Uncertain

Nomenclative note:
Gwynia capsula has been removed from the family Megathyrididae by LOGAN, MACKINNON & PHORSON (1997, pp. 249-250). These authors drew attention to similarities between *Gwynia* and the Jurassic genus *Zellania* MOORE, 1855 (Family uncertain), which exhibits several features similar to some characters observed in *Gwynia capsula* (see also BEECHER, 1893, pl. 1). The presence of submarginal ridges in the dorsal valve is certainly the most striking character which they have in common.

Genus *Gwynia* KING, 1859
Type species: *Terebratula capsula* JEFFREYS, 1859

Gwynia capsula (JEFFREYS, 1859)
Plate 1, Figures 1 a-e, 2 a-e.

* 1859 *Terebratula capsula* n. s. - JEFFREYS, p. 43, pl. 2, fig. 7a-b.
. 1859 *Gwynia capsula* - KING, **1**, p. 258, figs. 1-5.
. 1861 *Gwynia* - DAVIDSON, p. 28.
1861 Subgenus? uncertain (*Gwynia*, King). *Terebratula? capsula*, Jeffreys. - DAVIDSON, p. 39.
. 1863 *Argiope capsula*, Jeffreys. - JEFFREYS, p. 21.
1863 *Argiope Neapolitana* (probably *T. cordata* of Risso) - JEFFREYS, p. 22.
. 1865 *Gwynia capsula* - SARS, pp. 96-97, 127, 134, pl. 4, figs. 121-122.
. 1874 *Gwynia capsula*, Gwyn Jeffreys, sp. - DAVIDSON, **4**, p. 5, pl. I, figs. 3-4.
. 1877 *Gwynia (Argiope) capsula* Jeff. - FRIELE, **2**(4), pp. 385-386, pl. 3, fig. 7b.
. 1878 *Argiope capsula*, Jeffreys [placed in subgenus *Gwynia*] - JEFFREYS, p. 410-411.
. 1880 *Gwynia (Terebratula) capsula*, Jeff. - DAVIDSON, p. 14.
. 1883 *Argiope capsula*, Jeffr. - DUPREY, pp. 185-186.
. 1887 *Gwynia capsula*, Gwyn Jeffreys, sp.- DAVIDSON, pp. 150-152, pl. 21, figs. 28a-c, 29.
non 1891 *Gwynia capsula*, Gwyn Jeffreys, sp. - FISCHER & OEHLERT, pp. 125-128, fig. 12a-f.
pp. 1893 *Gwynia capsula* - BEECHER, pp. 377, 382-384, 386, 387, 391, pl. 1, figs. Aa, *non* fig. A.
1920 *Gwynia capsula* - DALL, pp. 324-325.
. 1925 *Gwynia capsula* (Jeff.) - MASSY, pp. 38-39, 42.
pp. 1927 *Gwynia capsula* - THOMSON, pp. 207-208, *non* fig. 61a-f, p. 208 (= "*Gwynia capsula*" *sensu* FISCHER & OEHLERT, 1891).
. 1933 *Gwynia capsula* (Gwyn Jeffreys 1859) - CORI, p. 148, text-fig. 19.
. 1933 *Gwynia capsula* (JEFFREYS) - STIASNY, p. 138.
. 1959 *Gwynia* - HYMAN, **5**(2), p. 1417.
. 1960 *Gwynia* - BEAUCHAMP, pp. 1406, 1417.
. 1963 *Gwynia capsula* Jeffries (*sic*) - BOADEN, p. 91.
pp. 1965 *Gwynia capsula* (JEFFREYS, 1859) - HATAI & ELLIOTT *in* MOORE, p. H832, *non* fig. 715,1a-e, p. H831 (= "*Gwynia capsula*" *sensu* FISCHER & OEHLERT, 1891).
. 1967 *Gwynia capsula* (Jeffreys) - SWEDMARK, pp. 1151-1152, fig. 1, p. 1151, fig. 2 (larva), p. 1152.
. 1971 *Gwynia capsula* Jeffreys - SWEDMARK, fig. 1-E, p. 43, p. 44.
. 1971 *Gwynia capsula* (Jeffreys) - RIOULT, pp. 26, 28.
. 1971 *Gwynia capsula* (Jeffreys) - HULINGS & GRAY, p. 43.
non 1975 *Gwynia capsula* Jeffreys, 1859 - ZEZINA, p. 193.
. 1976 *Gwynia capsula* Jeffreys, 1859 - ZEZINA, table 3, p. 17, pp. 21, 23, 111.
. 1978 *Gwynia capsula* (Jeffreys) - WILLIAMS & MACKAY, pp. 192, 193, 199, 200, pl. 4, figs. 17-19, pl. 5, fig. 20.
. 1979 *Gwynia* - WILLIAMS & MACKAY, p. 734.
. 1979 *Gwynia capsula* (Jeffreys) - BRUNTON & CURRY, pp. 21, 24, 46, fig. 23, p. 47.
non 1983 *Gwynia capsula* - LOGAN, table 1, p. 169 (= "*Gwynia capsula*" *sensu* FISCHER & OEHLERT, 1891).
. 1984 *Gwynia capsula* (Jeffreys, 1859) - BESTEIRO & URGORRI, pp. 219-224, pl. 1, figs. 5-10.
. 1985 *Gwynia capsula* (Jeffreys, 1859) - ZEZINA, p. 193.
. 1988 *Gwynia capsula* (Jeffreys) - NIELSEN, p. 445, fig. 50.1, p. 446.
. 1988 *Gwynia capsula* (Jeffreys) - PHORSON, pp. 32-34, fig. 2, p. 33.
non 1988 *Gwynia capsula* - LOGAN, table 1, p. 63 (= "*Gwynia capsula*" *sensu* FISCHER & OEHLERT, 1891).
. 1989 *Gwynia capsula* (Jeffreys, 1859) - SAIZ SALINAS, p. 146.
pp 1993 *Gwynia capsula* - LOGAN, table 3, p. 232 (*non* "*Gwynia capsula*" *sensu* FISCHER & OEHLERT, 1891).
. 1996 *Gwynia capsula* (JEFFREYS, 1859) - HARPER, DONOVAN & VELTKAMP, pp. 331-333, fig. 1(1-4), p. 332.
. 1997 *Gwynia capsula* (JEFFREYS, 1859) - LOGAN, MACKINNON & PHORSON, pp. 239-252, fig. 1, p. 242, fig. 2 (1-14), p. 244, fig. 3 (1-2), p. 246, fig. 4 (1-4), p. 248.

Material: 90 complete shells, 47 dorsal valves and 18 ventral valves collected from a submarine cave at a depth of 35 m in U Privlaka, Lošinj Island, Croatia.
Externally, specimens from U Privlaka have a biconvex, subcircular to slightly elongate shell, with a smooth surface except for faint growth lines. Some dissymmetrical shells are observed. The dorsal valve is a little larger than the ventral valve, the dorsal umbo being slightly longer than the ventral one. This character is unusual in articulate brachiopods and probably induced some misidentifications of brachial and ventral valves (HARPER *et al.*, 1996, p. 332, fig. 1). The amphithyrid foramen is large and rudimentary deltidial plates are present. The shell is endopunctate. A short pedicle collar is hardly visible in the ventral valve, which possesses small, pointed teeth, without dental plates. The dorsal valve has strong inner and outer socket ridges but is devoid of a cardinal process, hinge plates and septal pillar. The development, in the dorsal valve, of two postero-lateral submarginal ridges, arising from the valve floor, is a typical feature. These ridges

support a trocholophous lophophore (LOGAN, MACKINNON & PHORSON, 1997, p. 243).

This extremely small-sized brachiopod (largest individual found in U Privlaka: 1.02 mm. long and 0.84 mm. wide), living in a cryptic habitat, was probably overlooked in the western part of the Mediterranean. The Croatian population of *G. capsula* suggests a larger development for this species in the whole Mediterranean Sea.

Although *G. capsula* was described from Northern Ireland since 1859, very little was known about this species. FISCHER & OEHLERT (1891, p. 126, fig. 12a-f) reported the presence of "*Gwynia capsula* " at a great depth (822 and 4060 m) in the material collected by the Talisman (see also ZEZINA, 1975, pp. 193-194). They described and illustrated this specimen which, obviously, is not similar to the real *Gwynia capsula* (JEFFREYS, 1859). The beak of the ventral valve is clearly longer and pointed. Its triangular foramen is hypothyridid. ZEZINA (1976, p. 111) already pointed out the confusion in FISCHER & OEHLERT that produced further inaccurate representations for this species (HATAI, 1965 p. H831, fig. 1a-f and THOMSON, 1927 p. 208, fig. 61 a-f). The first photograph of *G. capsula* was surprisingly published only three years ago (HARPER *et al.*, 1996, pp. 331-332, figs. 1-1 & 1-2) but the dorsal and the ventral valve were confused. A recent reappraisal of the morphology, distribution, life habits and phylogenetic affinities of *G. capsula* establishes the taxonomic status and definitive characters of this brachiopod (LOGAN *et al.*, 1997, pp. 239-252).

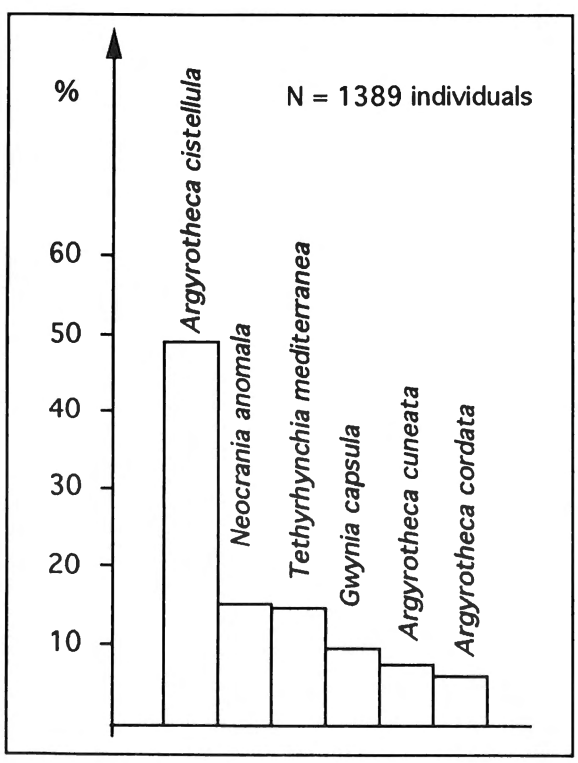

Fig. 2. – Relative abundance (as a % of the total number of individuals) of the different brachiopod species collected in the sediment of a submarine cave at U Privlaka, Lošinj Island, Croatia. N: total number of individuals found in 3 litres of dried bioclasts.

Conclusion

A study of a collection of Croatian brachiopods identified one new species for the Mediterranean and two new species for the Adriatic area. At shallow depths, caves offer ecological conditions similar to those observed in the bathyal zone. But they also represent specific environments for the development of specialised shallow water micro-brachiopods such as *Tethyrhynchia mediterranea*, *Argyrotheca cistellula* and *Gwynia capsula*.

In Croatia, *G. capsula* has not been found outside caves or in cavities situated on the drop off. If the original Atlantic ecological conditions of *G. capsula* are taken into account, Mediterranean karstic caves are ideal refuges for this species, which probably does not prefer higher water temperatures or strong fluctuations in water temperature. A further development of this study will describe more precisely on the living conditions of these micromorphic brachiopods.

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Plate 1

Gwynia capsula (JEFFREYS, 1859) from a semi-dark, submarine cave (depth: -35 m) in U Privlaka, Lošinj Island, Croatia.

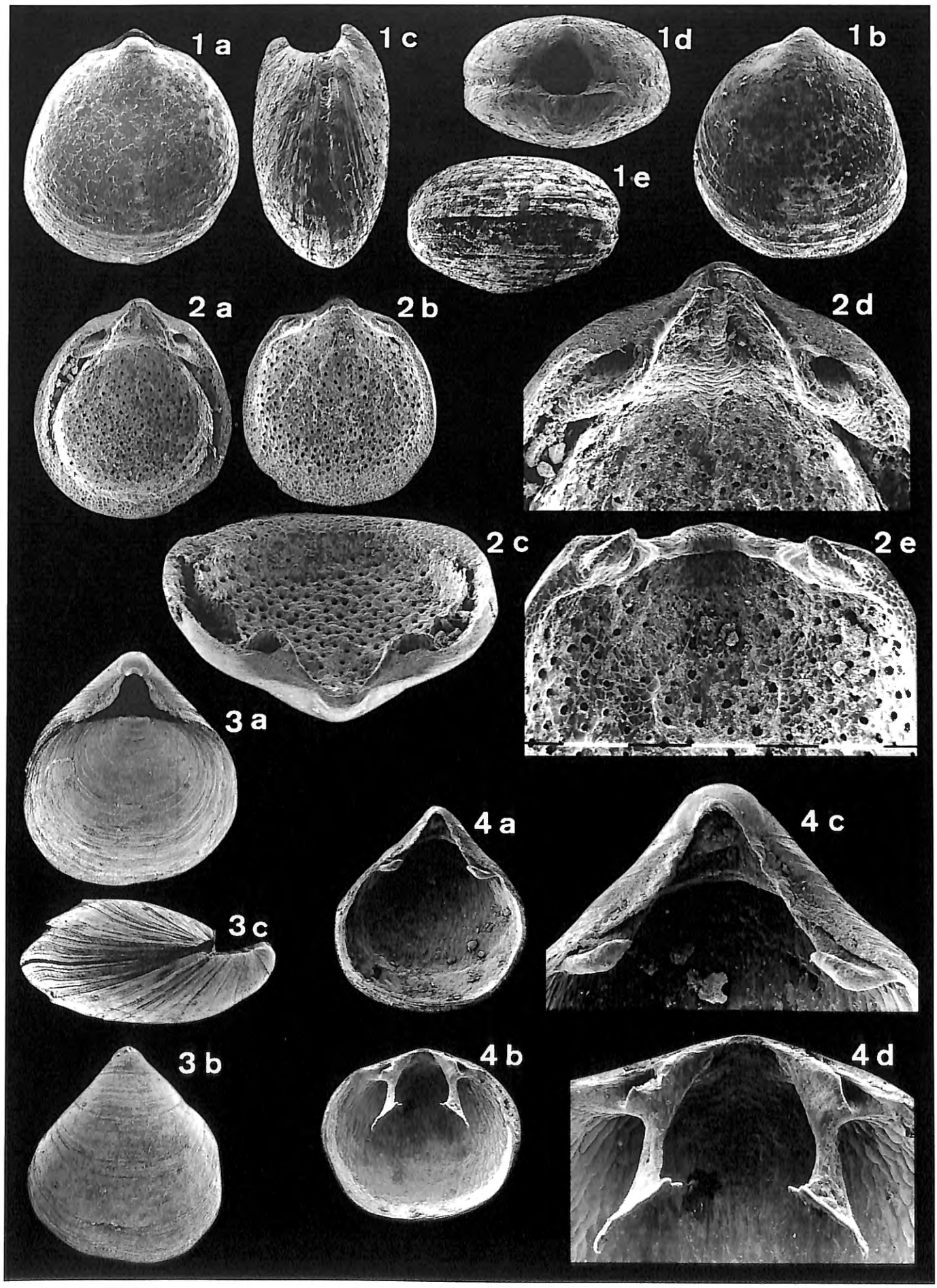
Fig. 1 - Complete adult specimen (x47). 1a- ventral view, 1b- dorsal view, 1c- lateral view, 1d- posterior view and 1e- anterior view (Specimen IRSNB-IST N°6392).

Fig. 2 - Another complete, opened specimen (IRSNB-IST N°6393). 2a- dorsal valve in ventral view (x47), 2b- ventral valve in dorsal view (x47), 2c- dorsal valve in posterior view showing the postero-lateral submarginal ridges (x80), 2d- dorsal valve, a detail of sockets and socket ridges (x 128), and 2e- ventral valve, a detail of the teeth (x128).

Tethyrhynchia mediterranea LOGAN, 1994 from a semi-dark, submarine cave (depth: -35 m) in U Privlaka, Lošinj Island, Croatia.

Fig. 3 - Complete adult specimen (IRSNB-IST n° 6390). 3a- dorsal view (x35), 3b- ventral view (x32), 3c- lateral view (x35).

Fig. 4 - Another complete, opened specimen (IRSNB- IST n°6391). 4a- ventral valve in dorsal view (x35), 4b- dorsal valve in ventral view (x35), 4c- same ventral valve, detail of teeth and pedicle collar (x96) and 4d- same dorsal valve, detail of sockets, socket ridges and lunifer crura (x96).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